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IS 10106-3-3 (1985): Packaging code, Part 3: Ancillary materials, Section 3: Tensional strapping [TED 24: Transport Packages]



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PACKAGING CODE “RE-AFFIRMED 1994”

PART 3 ANCILLARY MATERIALS

Section 3 Tensional Strapping

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Indian Standard

PACKAGING CODE

PART 3 ANCILLARY MATERIALS

Section 3 Tensional Strapping

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Indian Standard

PACKAGING CODE

PART 3 ANCILLARY MATERIALS

Section 3 Tensional Strapping

0. FOREWORD

0.1 This Indian Standard (Part 3/Sec 3) was adopted by the Indian Standards Institution on 20 March 1985, after the draft finalized by the Packaging Code Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 Tensional strapping is applied to packages by suitable tools and machines, and tied or sealed while under tension. It may be applied to wooden containers, crates, solid and corrugated fibreboard packing cases, bundles, bales, palletized and unitized loads, to manufacturing processes, and as safety factors in internal handling.

0.3 Strapping is used because it reinforces and strengthens the packages, protecting them against hazards of transportation, thus assisting in ensuring safe arrival at destination; it allows economies to be affected in container construction and in other packaging materials; it renders the contents of packages less liable for pilferage; it may be used as a method of closure. In addition, certain conditions experienced in handling and transit require the use of strapping as an additional safeguard, for example, load restraint.

0.4 This standard has been prepared to act as a guide for the user in selection and use of strapping to suit particular requirement.

0.5 In the preparation of this standard, assistance has been derived from BS 1133: Section 15: 1975 — Packaging code, tensional strapping, issued by the British Standards Institution (BSI).

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Rules for rounding off numerical values (revised).

1. SCOPE

1.1 This standard (Part 3/Sec 3) prescribes requirements for tensional strapping, both steel and non-metallic, and gives guidance on selection and use.

2. TYPES OF STRAPPING

2.1 Steel Strapping — The term steel strapping covers flat bone, hot rolled and cold-rolled strapping and wire of round, oval and flat section. IS : 1029-1970*, IS : 5872-1973† and IS: 280-1978‡ give dimensions, tensile strength, tolerances, surface finish, etc, for hot-rolled, cold-rolled strapping and round wires respectively.

2.2 Non-metallic Strapping

2.2.1 Weftless Strapping (Viscose/Polyester) — Weftless strapping consists of continuous strands of high tensile material laid side by side, and bonded together with suitable adhesive. Thickness varies according to the density of yarn used in its construction. The strapping is generally available in widths from 6 to 25 mm.

2.2.2 Thermoplastics Strapping (HDPE/Polyamide/Polypropylene) — Thermoplastics strapping is obtained by extrusion, generally of rectangular cross-section, in which high tensile strength has been developed by orientation. The strapping is generally available in widths from 5 to 25 mm.

2.2.3 Surface Finishes — The available surface finishes for the different types of non-metallic strapping are as under;

Surface Finish	Weftless Strapping		Thermoplastics Strapping			
	Viscose	Polyester	Polypropylene	Polyamide	Polyester	HDPE
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Natural	×	×	×	×	×	×
Coloured	×	×	×	×	×	×
Smooth	×	×	×	×	×	×
Embossed			×	×	×	×
Plain	×	×	×	×	×	×
Printed	×	×	×		×	×

*Specification for hot rolled steel strips (baling) (first revision).

†Specification for cold rolled steel strips (box strapping) (first revision).

‡Specification for mild steel wire for general engineering purposes (third revision).

3. TYPES OF EQUIPMENT

3.1 The types of equipment generally available and the types of strapping with which they are normally used are listed in Table 1. There is a full range of options giving degrees of mechanization with secondary options if required. The advice and guidance of manufacturers is offered freely in evaluating the requirements of a given strapping application and recommending suitable systems. Within the types of equipment set out in Table 1, there are obviously special features designed for specialized applications as well as secondary factors which will enhance standard equipment. Suppliers will provide the detailed information upon which a choice can be made. Semi-automatic, automatic and automated types of strapping equipment may be defined as follows:

3.1.1 Semi-Automatic — Machinery, generally static, which does not have a fixed track for feeding strapping around the article to be strapped. Feeding is by hand, the machine operator placing the leading end of a strap into the mechanism so that the remaining operations of the cycle, that is tensioning, sealing and cutting off, can be completed.

TABLE 1 TYPES OF EQUIPMENT

(Clause 3.1)

EQUIPMENT	COLD ROLLED	HOT ROLLED	WIRE	STAINLESS STEEL	WEFT- LESS	THERMO- PLASTICS
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Hand operated	×	×	×	×	×	×
Power assisted, portable	×	×		×	×	×
Fully powered, portable	×	×		×		×
Semi-a u t o m a t i c machines	×		×			×
Automatic machines	×		×		×	×
Automated machines	×		×			×
Semi- a u t o m a t i c pack compression	×					×
Automatic machines with pack compre- ssion	×				×	×
Custom built auto- matic systems	×					×

NOTE — Suppliers should be consulted to advise the suitability of strapping to meet the requirements of specific applying equipment.

3.1.2 Automatic — Machinery with a fixed track for feeding the strapping cycle are carried out in activation of the start control.

3.1.3 Automated — Implies the use of automatic machinery with additional electronic or other controls and a powered method of presenting packs to the strapping machine. An automated system could be capable, without the presence of an operator, of controlling the input flow of packs, strapping them at the correct points for the requisite number of straps to be applied (at pre-determined positions), activating the strapping machine and ejecting the strapped pack. Automation is a control system of variable sophistication, according to the requirements of the user and the strapping application.

4. METHODS OF JOINTING

4.1 The different methods of jointing strapping under tension are as under.

4.1.1 Sealing (Separate Seal) — The two ends of strapping are brought together and secured by a seal, clip, or fastener.

4.1.2 Seal-Less Joint — The two ends of strapping are brought together and jointed by a method not involving the use of a separate seal, for example, cutting and interlocking.

4.1.3 Welding — The ends of the strapping are fused together by the application of heat.

4.1.4 Friction Welding — The ends of the strapping are welded together by means of pressure and heat generated by rubbing one against the other.

4.1.5 Buckling — The two ends of the strapping are brought together and held by buckles of metal or plastics.

4.1.6 Tying — The two ends of the strapping are twisted together, either mechanically or by hand (this method includes preformed knotting).

4.2 Applicability of Methods

4.2.1 Suitable methods of jointing various types of strapping are given in Table 2.

5. STRENGTH OF JOINT

5.1 The joint strength varies considerably depending upon the type of seal, type of strapping and the dimensions of strap. In general, the joint strength should not be less than 50 percent of the parent strap for non-metallic strapping and 65 percent for metallic strapping.

TABLE 2 METHODS OF JOINTING FOR VARIOUS TYPES OF STRAPPING

(Clause 4.2.1)

TYPES OF STRAPPING	SEALING (SEPARATE)	SEAL-LESS JOINT	WELDING	FRICTION WELDING	BUCKLING	TIEING
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Steel bands	×	×	×	×		
Steel wires						×
Weftless tapes	×				×	
Thermoplastics	×		×	×	×	

6. PHYSICAL PROPERTIES AND USAGE CHARACTERISTICS

6.1 For details about tensile strength, elongation and other properties of cold-rolled steel strapping, hot-rolled strapping and round wire, reference may be made to IS : 5872-1973*, IS : 1029-1970† and IS : 280-1978‡. For non-metallic strapping the typical properties are as given in Table 3.

TABLE 3 TYPICAL PROPERTIES OF NON-METALLIC STRAPPING

MATERIAL	TENSILE STRENGTH, N/mm ²	ELONGATION AT BREAK, PERCENT
(1)	(2)	(3)
Weftless viscose	270 to 310	9 to 13
Weftless polyester	450 to 500	12 to 14
Extruded polypropylene	230 to 380	8 to 30
Extruded polyamide	380 to 450	12 to 20
Extruded polyester	350 to 620	5 to 20
HDPE	80 (Min)	20 (Min)

NOTE — Although metallic strapping is available suitably formulated to withstand impact shock, its effectiveness is mainly the function of high tensile strength. The effectiveness of non-metallic strapping on the other hand is due to the combination of tensile strength with a high degree of elongation before the limit of elastic recovery is reached. Hence the properties of elongation and tensile strength cannot be compared meaningfully between metallic and non-metallic strapping for a given cross section of strap.

6.2 Flexibility — The flexibility of strapping will determine its ability to conform to the shape of package.

*Specification for cold rolled steel strips (box strappings) (first revision).

†Specification for hot rolled steel strips (baling) (first revision).

‡Specification for mild steel wire for general engineering purposes (third revision).

6.3 Resistance to Deterioration — The basic properties of strapping may undergo a change by the conditions to which it is exposed. The effect of exposure to moisture, ultraviolet rays (sunlight), extremes of temperature, microbiological attack and corrosive atmospheres is described in 6.3.1 to 6.3.5.

6.3.1 Moisture — Steel strapping is unaffected by moisture in the short term but corrosion may result from prolonged exposure of certain finishes (see corrosion). Weftless viscose tape decreases in tensile strength when wet, but, in practice, because the material shrinks when wet, the effect of dampness helps to tighten the strapping round the container. The performance of thermoplastics and polyester weftless strapping is not normally affected by moisture.

6.3.2 Ultraviolet Radiation — Steel strapping is unaffected by ultraviolet radiation. However thermoplastics and weftless straps are liable to degradation by ultraviolet radiation.

6.3.3 Extreme Temperature — The properties of steel strapping are not materially affected by extremes of temperature. Non-metallic strapping is not appreciably affected by temperature variations within normal climatic limits that is, -40°C to $+40^{\circ}\text{C}$.

6.3.4 Microbiological Attack — Steel and thermoplastics strapping are inherently resistant to microbiological attack. However, weftless strapping can be treated specially to increase resistance to mould growth.

6.3.5 Corrosion — Steel strapping may be affected by prolonged exposure to moisture vapour or industrially polluted or marine atmospheres. Corrosion may also occur due to interaction between the strapping and the package, for example, bi-metallic corrosion. The effect of corrosion may be reduced by the choice of a suitable finish. Non-metallic strapping is not affected by corrosive atmospheres.

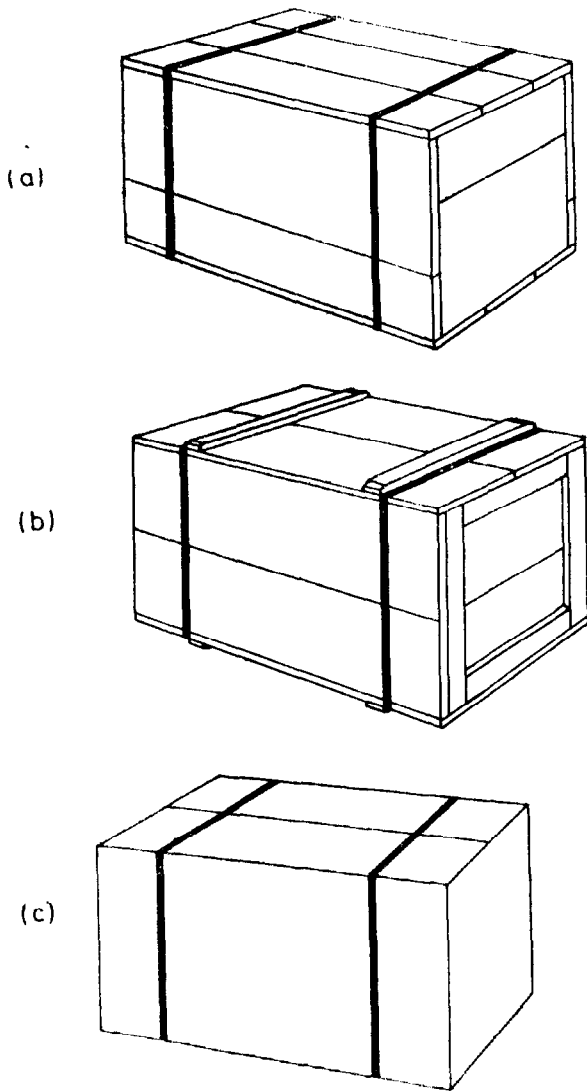
7. APPLICATION

7.1 All straps should normally be applied at right angles to the edges of package. Strapping should be applied sufficiently tight to ensure that they perform their function efficiently during the life of the package, but not so tight as to damage the container or its contents, or lead to breakage of the strapping. Edge protectors, pads, etc, should be interposed between the strapping and the container to protect edges and/or finishes where risk of damage is involved. Such devices may also be used when strapping relatively incompressible packages, for instance, steel drums to ensure greater friction between strapping and container, and thus preventing movement of the strapping. Non-metallic strapping is applied with an initial extension sufficient to compensate for the elasticity which is the feature of this type of material. This will also give additional stability to the package.

7.1.1 Where practicable, bridging that is a portion of wire or strapping not in contact with the package, should be avoided. Wherever possible steel strapping should be applied to wooden containers immediately before despatch, and this is particularly advisable if the timber has a high moisture content. Wire should not normally be applied along the grain of timber.

The following examples of the use of strapping are illustrated in Fig. 1 to 12:

- a) Strapping and securing wooden boxes, cases and crates, and solid and corrugated fibreboard packagings (*see* Fig. 1a, 1b and 1c).
- b) Securing collapsible and returnable packagings, the life of which can thus be lengthened. It is often unnecessary to secure the lids by means other than strapping (*see* Fig. 1c).
- c) *Unitizing* — This involves securing a number of individual articles or packages in one unit (*see* Fig. 2 and 3).
- d) Palletizing of suitable commodities (*see* Fig. 4, 5, 6, 7 and 8).
- e) *Partial crating* — Where complete crating is unnecessary protection of the outside corners, edges or breakable parts of a unit can be achieved by properly designed partial crating held securely in place by tensional strapping (*see* Fig. 9).
- f) Baling and bundling of suitable commodities (*see* Fig. 10 and 11).
- g) *Internal strapping* — When packing individual units, tensional strapping enables ancillary parts to be secured firmly to the interior of the transit container. Where no transit container is used such parts can be strapped directly to the major component (*see* Fig. 12).
- h) *Freight security* — Strapping may be used for securing loads to vehicles or freight containers in transit.



NOTE — Whenever any metallic strap is used for solid and corrugated fibre-board cases, it is recommended to use paper board pads beneath the point of contact along the horizontal edges.

FIG. 1 STRAPPING OF WOODEN BOXES AND CASES AND SOLID AND CORRUGATED FIBREBOARD PACKING CASES

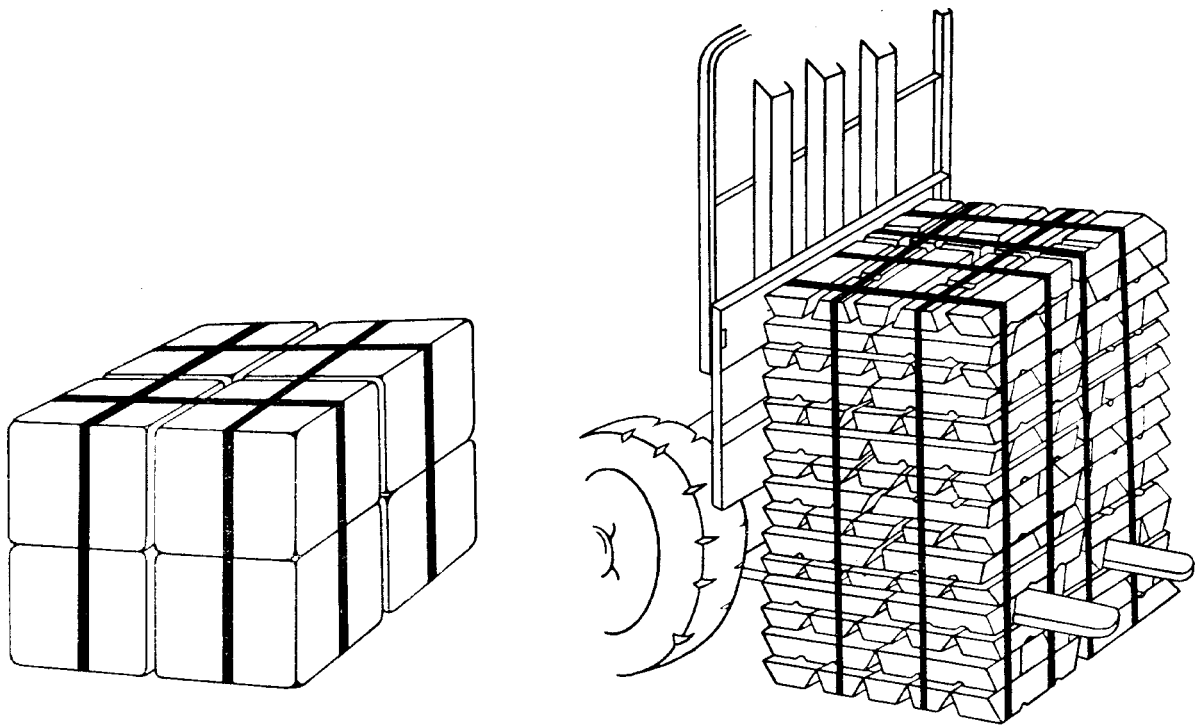


FIG. 2 UNITIZING

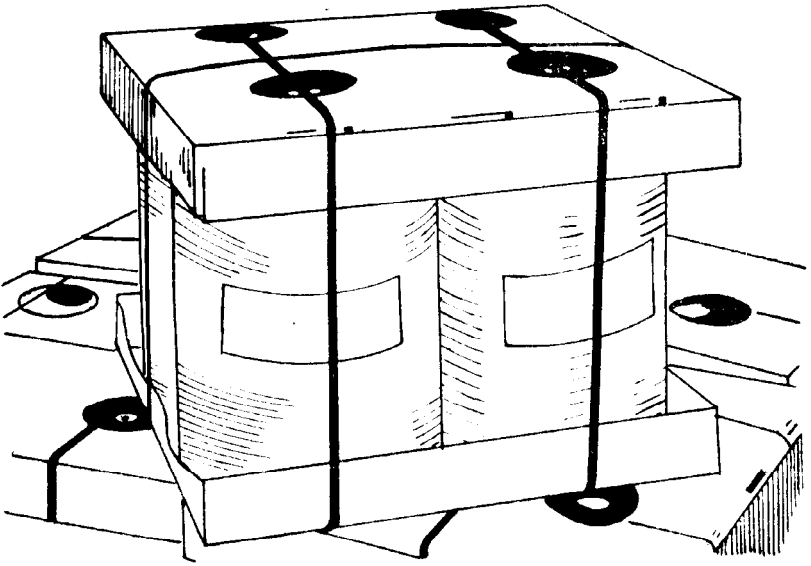


FIG. 3 METHOD OF STRAPPING A UNITIZED LOAD

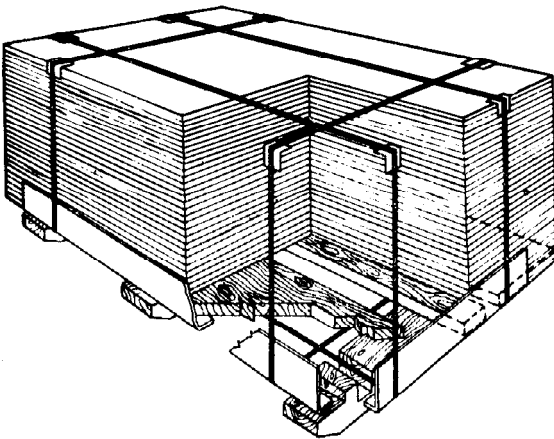


FIG. 4 SKID PACKING

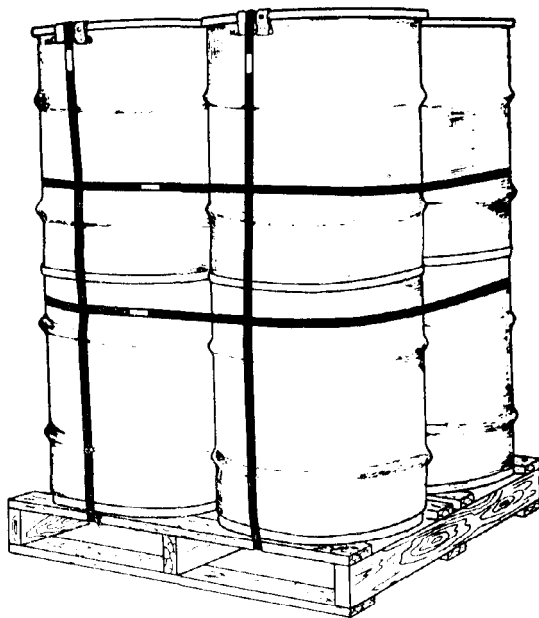


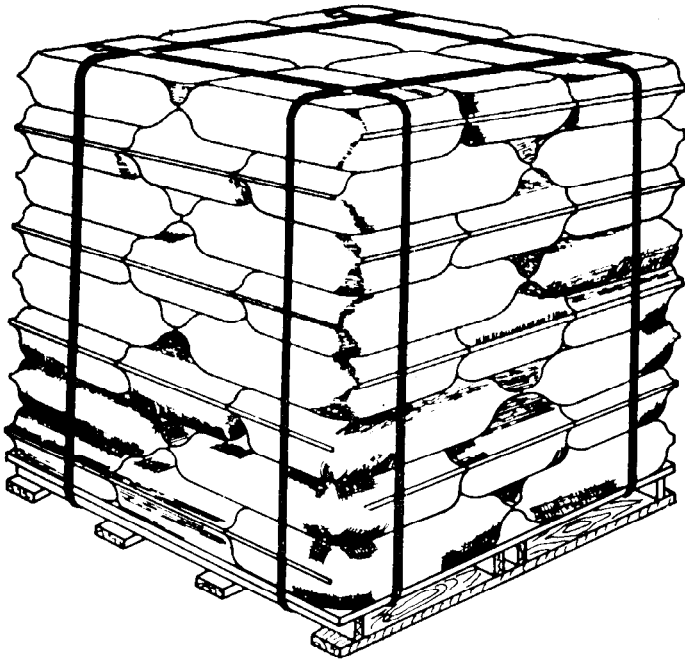
FIG. 5 PALLETIZING DRUMS FOR EXPORT SHIPMENT

8. CHOICE OF TENSIONAL STRAPPING

8.1 In determining the size, number and type of straps to be used, consideration shall be given to the shape, size and distribution of mass of the package or load, the material from which it is made, and the handling, storage and transport conditions likely to be encountered. The properties of the various types of strapping outlined in 6 and 7 as well as the factors listed below also need to be considered for selecting the type of strap to be used:

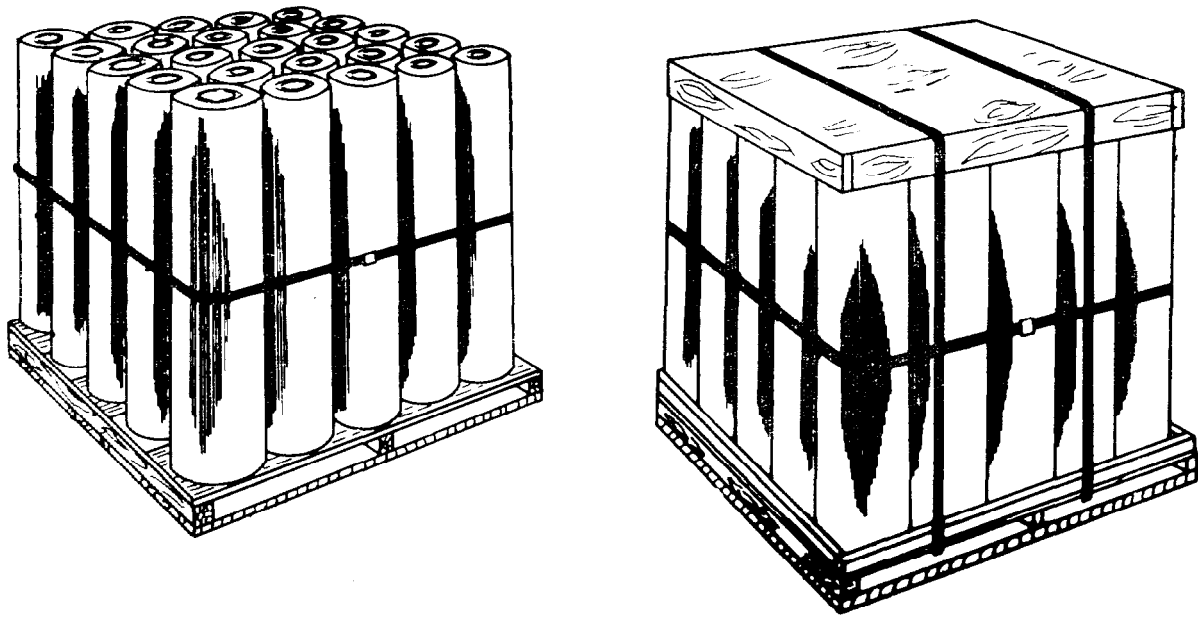
- a) Degree of mechanization required in the strapping system;
- b) Strapping rate required to meet output;
- c) Power sources available for strapping appliances;

- d) Number and location of strapping points proposed;
- e) Mobility requirements, if any, of the strapping system;
- f) Operating costs; and
- g) The nature of the pack and its resistance or otherwise to dimensional change through expansion, contraction, settlement, bruising, etc.



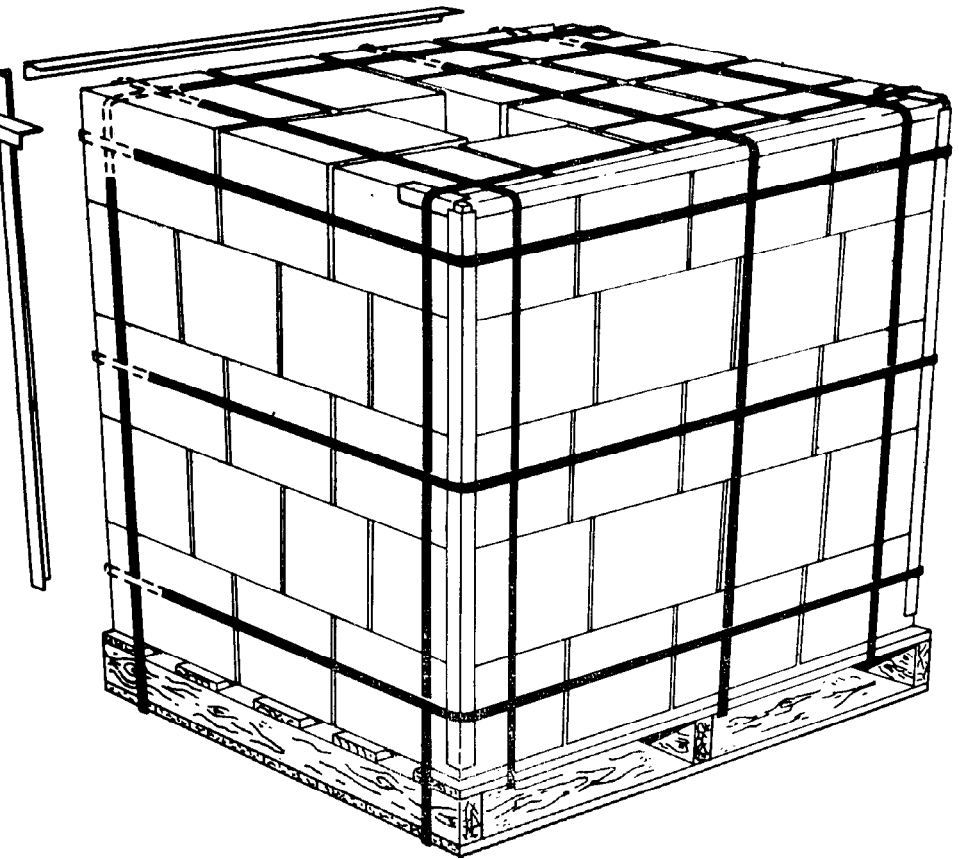
NOTE — Most granular or powdered material will settle during transit or storage. In order to maintain a tight pallet load a non-metallic strap, which will contract but still maintain its tension, is necessary. If the anticipated contraction is too great then pre-compression of the load in conjunction with a non-metallic strap, to offset any further settlement, will be required.

FIG. 6 METHOD OF STRAPPING A PALLETIZED LOAD OF SACKS



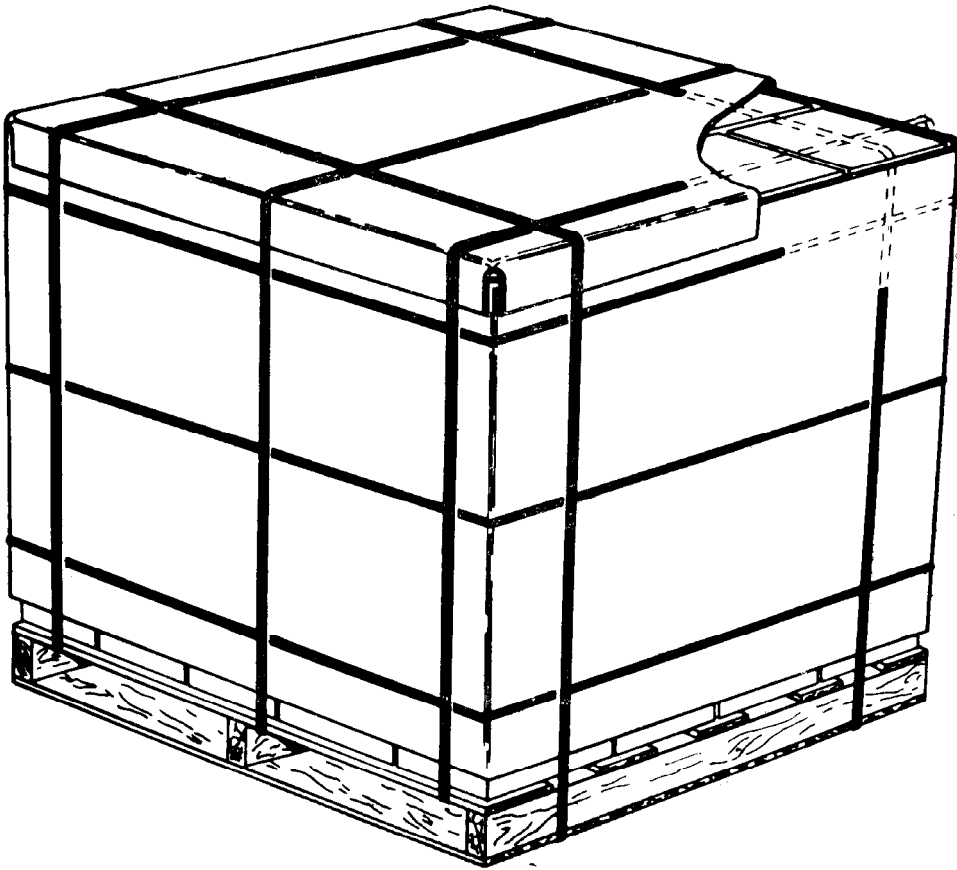
14

FIG. 7 METHOD OF STRAPPING LINOLEUM ROLLS ON A PALLET



8A

FIG. 8 METHODS OF STRAPPING PALLETIZED LOADS (*Continued*)



8B

FIG. 8 METHODS OF STRAPPING PALLETIZED LOADS

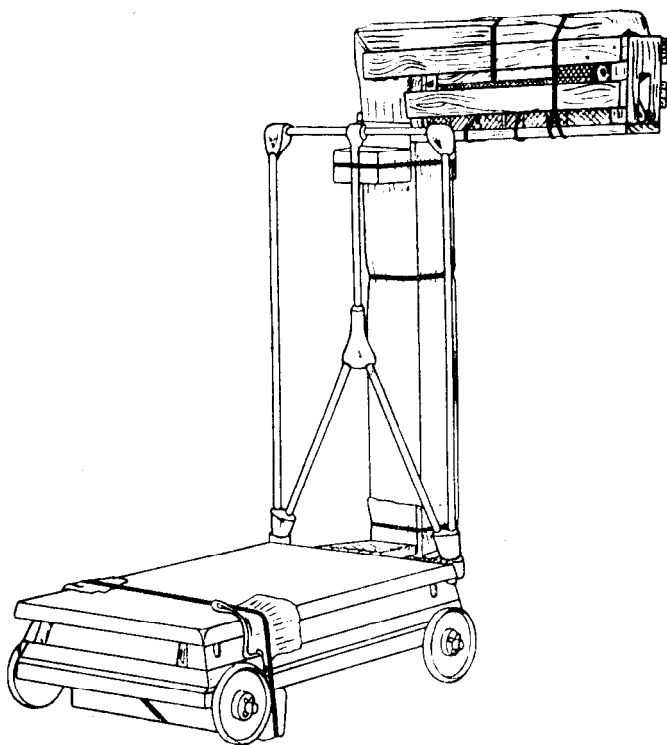


FIG. 9 PARTIAL CRATING

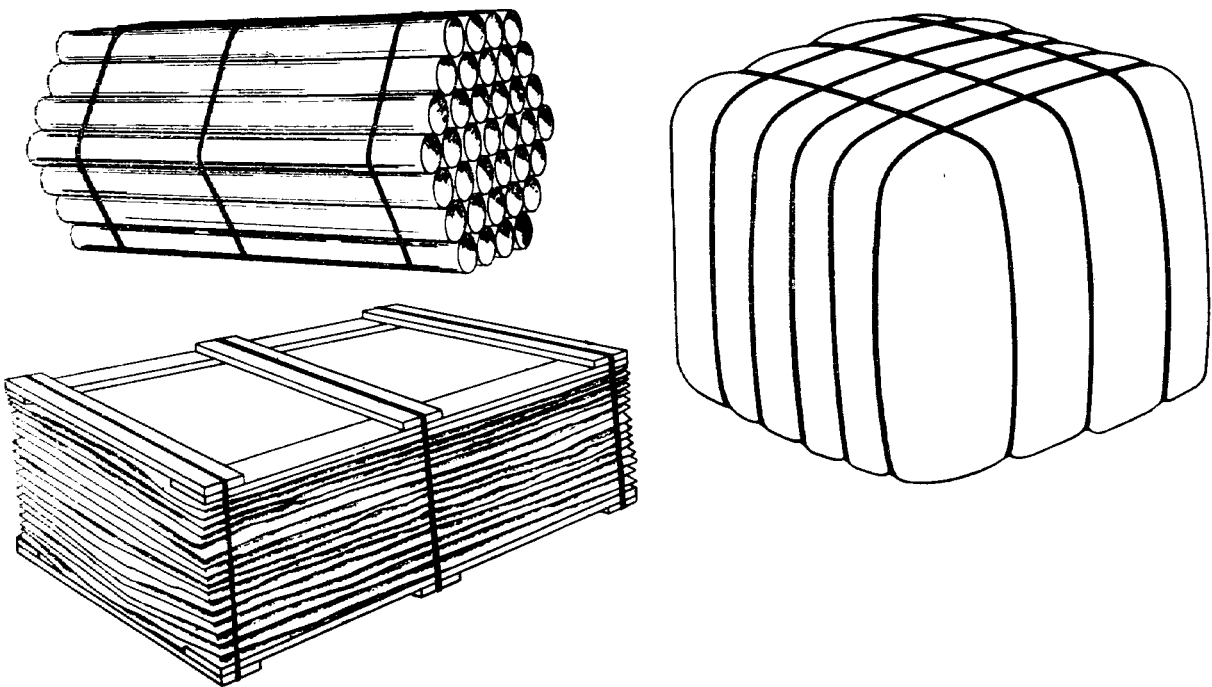


FIG. 10 BAILING AND BUNDLING

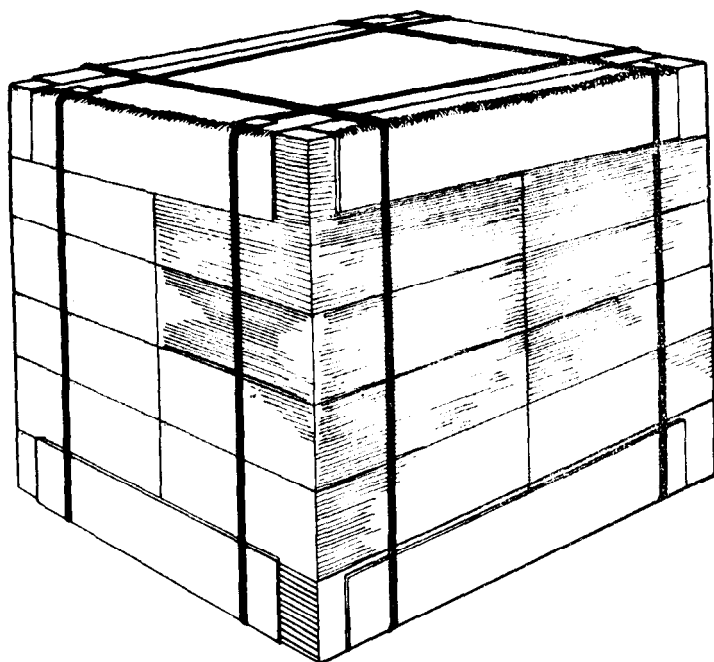


FIG. 11 METHOD OF STRAPPING A FIBREBOARD BALE

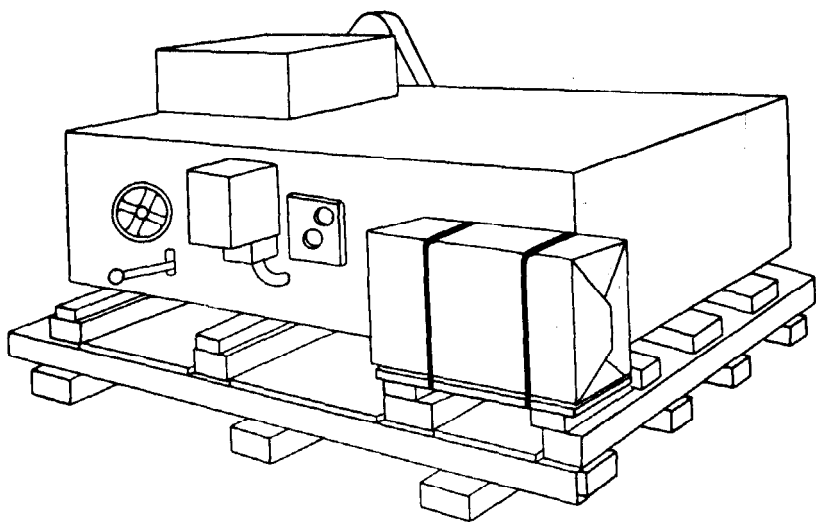


FIG. 12 TENSIONAL STEEL STRAPPING SECURING A CASE OF ACCESSORIES (OVERWRAPPED IN BITUMINOUS PAPER) TO THE BASE OF AN EXPORT PACKING CASE